**Red Planet Recycle – Informal Meeting**

**Minutes**

Wednesday 18th January 2012

**Group Members attending**

Yassen Abbas (Y.A) Gareth Herron (G.H) Charlotte Raymond (C.R)

Jamie Cassels (J.C) Sam Jones (S.J) Samuel Walpole (S.W)

Malcolm Chambers (M.C) Dylan Martin (D.M) James Young (J.Y)

Scott Clark (S.C) Bo Peng (B.P) Lois Doig (L.D)

Supervisors not present.

**Minutes**

It was necessary to develop criteria that would enable processes to be selected for use on the Mars station. The processes were divided into two categories: air treatment and water treatment. The criteria used to select processes that would be considered were:

1. Resupply (i.e. minimizing the re-supplement cargo)
2. Reliability
3. Heritage
4. Modularity
5. Complexity

The above criteria were adapted from the report “An evaluation of the vapor phase catalytic ammonia removal process for use in a Mars transit vehicle” by Flynn & Borchers. These criteria were to be applicable to both the water treatment processes and the air treatment processes, with two additional criteria applicable only to the water processes:

1. Main objective treating water (i.e. not producing energy)
2. Universally treats all impurities

**Water Treatment**

The criteria discussed previously were used to assess the all water purification processes. The results were as follows:

* On the grounds of reliability, all processes relying on biological organisms were deemed unsuitable for use on Mars, since the risk of the organisms dying, either in the 18 month journey to mars or after arrival, was decided to be unacceptable. The processes that this applied to were: aerobic digestion, bioreactors, anaerobic digestion, ecocyclet and bioremediation.
* On the grounds of resupply, the advanced oxidation reaction was deemed to be unsuitable for water treatment on a Mars station, due to its high resupply requirement of hydrogen peroxide.

These eliminations narrowed down the list of possible water treatment processes to the following:

* Electrocoagulation (although it is necessary to investigate the rate at which electrodes must be resupplied to the process)
* Membrane separations (nanofiltration)
* ISS baseline technology
* VPCAR
* DOC

These processes were to be examined in a quantitative manner. Members of the group to investigate these water treatment processes are: G.H., Y.A., M.C., L.D. and S.W.

**Air Treatment**

Air treatment was divided into three sections:

1. Separating the CO2 from the atmosphere in the station
2. Converting the CO2 to water
3. Converting the water to H2 and O2

1. As pointed out by the supervisors at the meeting on the 17th of January, we have not yet considered methods to separate the CO2 from the air in the station. S.C., S.J. D.M. and C.R. to investigate these methods.

2. The criteria were applied to air treatment methods, leaving the following processes:

* Sabatier
* Reverse Water Gas Shift
* Bosch

J.Y. to re-assess Bosch reaction’s feasibility in order to compare it with the other two air treatment processes.

3. Previously, electrolysis has been viewed as the only method by which water can be separated into H2 and O2. J.C. and B.P. to investigate other means of converting water to O2.

**Other Points Arising at Meeting**

Constraints were put in place on the water composition. The water composition before treatment was assumed to be (in ppm):

Ammonia 55, calcium 0.9, chlorine 229, phosphate 134, sulphate 80, Nitrate <100, sodium 150, potassium 133, magnesium 1.5, TOC >11

The water composition after treatment was assumed to be:

Ammonia 0.05, calcium 30, chlorine 200, phosphate N/A, sulphate 250, Nitrate 10, sodium N/A, potassium 340, magnesium 50, TOC <0.5

The water flowrate was to be 200.6 kg/day.

Constraints were also applied to the air in the station. It was assumed that the Nitrogen gas was a buffer gas and that its concentration was unchanged. It was also assumed that the metabolic requirement for O2 was 8.4 kg/day and that 10 kg/day of CO2 would be produced.

The concentration of CO2 was unknown at this stage as it is dependent on the volume of the station and the rate at which it is processed.

**Other Tasks**

S.W. to begin collating the report, volume 1.

Y.A. to begin making a presentation using the systematic approach suggested by Dr Sarkisov at the meeting on 17th Jan.

Next meeting will be on Monday 23rd Jan at 1200 (J.Y. to book a room)